A SYSTEM FOR ASSISTING THE REGENERATION OF DEPOLLUTION MEANS INTEGRATED IN AN EXHAUST LINE OF A VEHICLE DIESEL ENGINE

The present invention relates to a system for assisting the regeneration of depollution means associated with oxidation catalyst-forming means and integrated in an exhaust line of a motor vehicle diesel engine.

More particularly, the invention relates to a system in which the engine is associated with a common manifold or "rail" for feeding fuel to the cylinders of the engine and adapted to implement, at constant torque, a regeneration strategy by injecting fuel into the cylinders in at least one postinjection operation.

During regeneration of depollution means such as a particle filter, for example, stages in which the vehicle accelerator pedal is being raised (no fuel injection in normal operation), and stages in which the engine is idling (very low exhaust temperature), a problematic since they cause the exhaust temperature to drop, i.e. the temperature of the exhaust line and of elements integrated therein.

The use of one or more postinjections during these stages in the lifetime of the engine serves to limit the temperature drop in the exhaust line, by relying on the catalytic conversion of the HCs produced by combustion of the or each postinjection in the engine.

However, such strategies rely on an exothermic reaction being produced by the catalyst-forming means, which means, e.g. comprising an oxidation catalyst for a NOx trap with a CO/HC oxidation function, are assumed to be active.

During stages in which the engine is returning to idling, as a result of the accelerator pedal being raised, there is no main injection nor any pilot injection, and as a result, the or each postinjection does not burn in the cylinder, which does no more than

vaporize the fuel in the form of HCs that are subsequently converted by the catalyst-forming means.

The temperature at the inlet to the oxidation catalyst-forming means is thus very low, and in spite of the exothermic reaction produced by the catalytic combustion of the HCs coming from the or each postinjection, the front face of the catalyst-forming means cools down progressively and its conversion activity becomes progressively deactivated.

During a prolonged stage of returning to idling, it can happen then the catalyst-forming means are therefore not sufficiently active to convert all of the HCs, which leads to HC peaks downstream from the catalyst-forming means, or even the blue smoke and/or exhaust odors.

Furthermore, the use of postinjections leads to the lubricating oil being diluted by fuel, thereby degrading its lubrication properties, and in particular lowering its viscosity, and if the viscosity becomes too low, that can lead to damage to the engine.

The object of the invention is thus to solve these problems.

To this end, the invention provides a system for assisting the regeneration of depollution means associated with oxidation catalyst-forming means, and integrated in an exhaust line of a motor vehicle diesel engine, and in which the engine is associated with common rail means for feeding fuel to the cylinders of the engine and adapted, at constant torque, to implement a strategy of regeneration by injecting fuel into the cylinders in at least one postinjection, the system being characterized in that it comprises:

- detector means for detecting a request for regeneration and thus for postinjection;
- detector means for detecting that the vehicle accelerator pedal is being raised;
- acquisition means for acquiring the temperature downstream from the catalyst-forming means;

· determination means for determining, on the basis of said temperature, a maximum duration for applying postinjections during a stage in which the engine is returning to idling as a result of the accelerator pedal being raised; and

· cutoff means for immediately cutting off the or each postinjection as soon as the duration of postinjection use has reached the predetermined maximum duration of application.

According to other characteristics:

· the depollution means comprise a particle filter;

· the depollution means comprise a NOx trap;

· the fuel includes an additive for becoming deposited together with the particles with which it is mixed on the depollution means in order to facilitate regeneration thereof;

· the fuel includes an additive forming a NOx trap; and

· the engine is associated with a turbocharger.

The invention can be better understood on reading the following description given purely by way of example and made with reference to the accompanying drawing, in which:

· Figure 1 is a block diagram showing the general structure of a system of the invention for assisting regeneration; and

· Figure 2 is a flow chart showing the operation thereof.

Figure 1 shows the general structure of the system for assisting in the regeneration of depollution means, given overall reference 1 in this figure, associated with means forming an oxidation catalyst, given overall reference 2, and integrated in an exhaust line 3 of a motor vehicle diesel engine 4.

The engine may be associated with a turbocharger, and in this case the turbine portion 5 thereof is also associated with the exhaust line, the compressor portion

6 of the turbocharger being placed upstream of the engine.

The engine is also associated with common manifold or "rail" means 7 for feeding fuel to the cylinders of the engine, and adapted, at constant torque, to implement a regeneration strategy by injecting fuel into the cylinders, in at least one postinjection operation, in conventional manner.

These means are controlled by a control unit, given overall reference 8, that is adapted to detect a request req.RG for regeneration and thus for postinjection, e.g. as delivered by the supervisor of the depollution means, and the control unit 8 is also connected to means 9 for detecting a state in which the vehicle accelerator pedal is being raised.

These means may present any suitable structure.

The control unit 8 is also connected to means for acquiring the temperature downstream from the catalyst-forming means 2, these temperature acquisition means being given overall reference 11.

These means comprise any suitable temperature sensor.

This then makes it possible for the control unit 8, after detecting a request for regeneration and thus for postinjection, to detect a state in which the vehicle accelerator pedal is being raised, as shown by step 12 in figure 2.

The unit 8 is then adapted to acquire the temperature downstream from the catalyst-forming means during a step 13 and to determine a maximum duration for applying postinjections while at the engine is returning to idling as a result of the accelerator pedal being raised, on the basis of the said temperature during a step 14.

In steps 15 and 16, the unit 8 then monitors the duration of postinjection use and detects the moment when

said duration of use reaches the predetermined maximum duration of application.

As soon as the duration of use has reached the predetermined maximum duration of application during a stage in which the engine is returning to idling as a result of the accelerator pedal being raised, as shown by step 17, the pilot unit 8 is adapted to interrupt immediately the or each postinjection, as illustrated by step 18.

It should also be observed that such a system can operate with depollution means formed by a particle filter, or a NOx trap, and that it is also possible, in conventional manner, to mix an additive with the fuel for the purpose of depositing the additive together with the particles with which it is mixed on the depollution means in order to facilitate regeneration thereof by lowering the combustion temperature of soot trapped therein.

In conventional manner, the additive remains present in the particles after the fuel containing the additive has burnt in the engine.

It is also possible to envisage using an additive forming a NOx trap.

It can thus be understood that by means of such a structure, a maximum duration is allowed for applying postinjections during a stage in which the accelerator pedal is being raised.

This maximum duration is presented in the form of a timer which empties, i.e. which counts down or decrements during the stage in which the accelerator pedal is being raised in a stage while regeneration is taking place. The counter is reinitialized at the end of this stage.

This system serves the limit of the quantities of fuel there are postinjected while the accelerator pedal is being raised when the temperature levels in the exhaust line are the least favorable.

By limiting in this manner the total quantity of fuel that is postinjected during this stage, which is not

the most effective from the point of view of regenerating the depollution means, the proportion of postinjection time that is effective is optimized and the extent to which the lubricating oil of the engine is diluted by the fuel is limited.

Finally, this also serves to limit the risk of the oxidation function becoming suddenly deactivated, which would lead to a deficit in the conversion of HCs, and thus to a puff of HCs in the exhaust that could lead to smoke and/or odors.

Naturally, other embodiments could be envisaged.

Thus, for example, the depollution means and the oxidation catalyst-forming means could be integrated in a single element, and in particular on a common substrate.

By way of example, a particle filter integrating the oxidation function could be envisaged.

Similarly, a NOx trap integrating such an oxidation function could also be envisaged, whether using an additive or not.

This oxidation and/or NOx trap function could be performed for example by an additive mixed with the fuel.